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# Joint Polar Satellite System (JPSS) Algorithm Specification Volume I: Software Requirement Specification (SRS) for the Snow Cover

## Block 2.0.0


National Aeronautics and
Space Administration

**Goddard Space Flight Center**
**Greenbelt, Maryland**

# Joint Polar Satellite System (JPSS)
# Algorithm Specification Volume I:
# Software Requirement Specification (SRS)
# for the Snow Cover
# JPSS Review/Approval Page

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# Preface

This document is under JPSS Ground Project configuration control. Once this document is approved, JPSS approved changes are handled in accordance with Class I and Class II change control requirements as described in the JPSS Configuration Management Procedures, and changes to this document shall be made by complete revision.

Any questions should be addressed to:

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# Change History Log

| Revision | Effective Date | Description of Changes (Reference the CCR & CCB/ERB Approve Date) |
|---|---|---|
| Rev - | August 8, 2013 | This version incorporates 474-CCR-13-1148 which was approved by the JPSS Ground ERB on the effective date shown. |
| A | Jan 16, 2014 | This version incorporates 474-CCR-13-1406 which was approved by JPSS Ground ERB on the effective date shown. |
| A1 | Oct 23, 2014 | This version incorporates 474-CCR-14-2091 which was approved by the JPSS Ground ERB for CO10 on the effective date shown. |
| B | Jan 07, 2015 | This version incorporates 474-CCR-14-1721, 474-CCR-14-1741, 474-CCR-14-1781, and 474-CCR-14-2180 which was approved by JPSS Ground ERB on the effective date shown. |
| C | Mar 31, 2016 | This version incorporates 474-CCR-14-2110, 474-CCR-15-2452, 474-CCR-15-2480, 474-CCR-15-2657, and 474-CCR-16-2825 which was approved by JPSS Ground ERB on the effective date shown. |
| 0200D | Sep 22, 2016 | This version incorporates 474-CCR-16-2939 and 474-CCR-16-3049 which was approved by JPSS Ground ERB on the effective date shown. |

## Table of TBDs/TBRs

| TBx | Type | ID | Text | Action |
|---|---|---|---|---|
| None | | | | |

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# 1 Introduction

The Joint Polar Satellite System (JPSS) is the National Oceanic and Atmospheric Administration's (NOAA) next-generation operational Earth observation program that acquires and distributes global environmental data primarily from multiple polar-orbiting satellites. The program plays a critical role in NOAA's mission to understand and predict changes in weather, climate, oceans and coasts, and the space environment, which support the Nation's economy and protect lives and property. The first JPSS satellite mission, the Suomi National Polar-orbiting Partnership (S-NPP) satellite, successfully launched in October 2011. S-NPP, along with the legacy NOAA Polar Operational Environmental Satellites (POES), provides continuous environmental observations. Two JPSS satellites will follow S-NPP: JPSS-1, planned for launch in fiscal year (FY) 2017, with JPSS-2 to follow in FY2021. In the future, the JPSS Polar Follow-On (PFO) provides for two additional missions, JPSS-3 and JPSS-4, as follow-on to the JPSS-2 mission to extend the JPSS Program lifecycle out to 2038.

In addition to the JPSS Program's own satellites operating in the 1330 (±10) Local Time of the Ascending Node (LTAN) orbit, NOAA also leverages mission partner assets for complete global coverage. These partner assets include the Department of Defense (DoD) Defense Meteorological Satellite Program (DMSP) operational weather satellites (in the 1730 - 1930 LTAN orbit), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) Meteorological Operational (Metop) satellites (in the 2130 LTAN orbit) and the Japanese Aerospace Exploration Agency (JAXA) Global Change Observation Mission-Water (GCOM-W) satellite (in the 1330 LTAN orbit). JPSS routes Metop data from McMurdo Station, Antarctica to the EUMETSAT facility in Darmstadt, Germany and EUMETSAT, in turn, provides Metop data to NOAA. For GCOM, JPSS routes the GCOM-W data from Svalbard, Norway to the NOAA Satellite Operations Facility (NSOF) in Suitland, MD, processes GCOM-W data and delivers GCOM-W products to the JPSS users who have JAXA permissions.

Additionally, the JPSS Program provides data acquisition and routing support to the DMSP and the WindSat Coriolis Program. JPSS routes DMSP data from McMurdo Station to the 557$^{th}$ Weather Wing at Offutt Air Force Base in Omaha, NE. After processing, the 557$^{th}$ releases the DMSP data for public consumption over the Internet via the National Geophysical Data Center in Boulder, CO. The JPSS Program provides data routing support to the National Science Foundation (NSF), as well as the National Aeronautics and Space Administration (NASA) Space Communications and Navigation (SCaN)-supported missions, which include the Earth Observing System (EOS). As part of the agreements for the use of McMurdo Station, JPSS provides communications/network services for the NSF between McMurdo Station, Antarctica and Centennial, Colorado.

As a multi-mission ground infrastructure, the JPSS Ground System supports the heterogeneous constellation of the before-mentioned polar-orbiting satellites both within and outside the JPSS Program through a comprehensive set of services as listed in Table 1-1.

**Table: 1-1 JPSS Ground System Services**

| Service | Description |
|---|---|
| Enterprise Management and Ground Operations | Provides mission management, mission operations, ground operations, contingency management and system sustainment |
| Flight Operations | Provides launch support and early orbit operations, telemetry and commanding, orbital operations, mission data playback, payload support, flight software upgrade, flight vehicle simulation, and disposal at the end of mission life |
| Data Acquisition | Provides space/ground communications for acquiring mission data |
| Data Routing | Provides routing of telemetry, mission and/or operations data through JPSS' global data network |
| Data Product Generation | Provides the processing of mission data to generate and distribute raw, sensor, environmental, and ancillary data products |
| Data Product Calibration and Validation | Provides calibration and validation of the data products |
| Field Terminal Support | Provides development and operational support to the Field Terminal customers |

## 1.1 Identification

This SRS provides requirements for the Snow Cover Binary Map and Snow Cover Fraction Environmental Data Records (EDRs) based on the measurement observation by Visible Infrared Imaging Radiometer Suite (VIIRS). These VIIRS Snow Cover EDR products are retrieved by an automated algorithm. The process flow is implemented within the Snow/Ice Module by the independent testable Snow Cover software unit.

Because of its high albedo, snow is an important factor in determining the radiation balance, with implications for global climate studies. General circulation models (GCM) do not simulate the Arctic climate very well, indicating the need to improve measurements of the global snow cover. Weekly snow cover maps of the Northern Hemisphere have been produced since 1966 by the National Oceanic and Atmospheric Administration (NOAA). Daily and 8-day composite global maps are an objective of the National Aeronautics and Space Administration (NASA) Moderate Resolution Imaging Spectroradiometer (MODIS) instrument. Regionally, the measurement of snowpack properties is vital to the prediction of water supply and flood potential. Regional snow products with 1 km resolution are produced by the National Weather Service, and at 500 meter resolution from MODIS http://modis-snow-ice.gsfc.nasa.gov/snow.html. The objective of the VIIRS retrieval is to achieve the performance specifications designed to meet the requirements stated in the JPSS Program Level I Requirements Supplement (JPSS-REQ-1002).

## 1.2 Algorithm Overview

The main steps in the process flow are as follows:

1) Input data for the current VIIRS granule is extracted by the *Extract VIIRS Snow Data* process. If all pixels are designated as Ocean in the Cloud Mask EDR, processing is bypassed and a null EDR file is written.

2) The *Make Snow Pixel Masks* process performs pixel masking and pixel weighting, using information in the VIIRS EV_375M SDR, VIIRS Aerosol Optical Thickness IP, VIIRS Cloud Optical Thickness IP, VIIRS Cloud Mask IP, and a Snow Quality LUT. The process produces a pixel quality mask and pixel weights for each band.

3) Observed Top-of-Atmosphere (TOA) reflectance from VIIRS imagery resolution bands I1 (Visible), I2 (Near Infrared - NIR), and I3 (Short Wave Infrared - SWIR) are obtained from the VIIRS EV_375M SDR. Observed brightness temperature for the VIIRS I5 band is also obtained from the SDR. Bad pixels are identified from the Imagery Snow Mask, and the Imagery Band

Weights. The *Compute Snow Binary Map* process calculates a snow/no snow binary map for each good imagery resolution pixel, using the snow binary map algorithm adapted from MODIS.

4) Observed Brightness temperatures for the VIIRS M15 and M16 bands moderate resolution bands are obtained from the VIIRS EV_750M SDR. The moderate resolution brightness temperatures are utilized for screening of pixels with brightness temperatures exceeding a tunable threshold temperature value in the event that the I5 band brightness temperature is bad quality. Bad pixels are identified from the Moderate Snow Mask, and the Moderate Band Weights.

5) The snow/no snow binary map for each imagery resolution pixel is written to the VIIRS Snow Cover EDR, along with associated pixel quality flags. The snow fraction for each moderate resolution pixel is also written to the EDR, along with associated pixel quality flags and pixel weights. The snow fraction pixel weight is the total of the individual band weights for that pixel, as determined by the *Make Snow Pixel Quality Masks* process.

## 1.3 Document Overview

| Section | Description |
|---|---|
| Section 1 | Introduction - Provides a brief overview of the JPSS Ground System and the relevant algorithm, as reference material only. |
| Section 2 | Related Documentation - Lists related documents and identifies them as Parent, Applicable, or Information Documents such as, MOAs, MOUs, technical implementation agreements, as well as Data Format specifications. This section also establishes an order of precedence in the event of conflict between two or more documents. |
| Section 3 | Algorithm Requirements - Provides a summary of the science requirements for the products covered by this volume. |
| Appendix A | Requirements Attributes - Provides the mapping of requirements to verification methodology and attributes. |

# 2 Related Documentation

The latest JPSS documents can be obtained from URL: https://jpssmis.gsfc.nasa.gov/frontmenu_dsp.cfm. JPSS Project documents have a document number starting with 470, 472 or 474 indicating the governing Configuration Control Board (CCB) (Program, Flight, or Ground) that has the control authority of the document.

## 2.1 Parent Documents

The following reference document(s) is (are) the Parent Document(s) from which this document has been derived. Any modification to a Parent Document will be reviewed to identify the impact upon this document. In the event of a conflict between a Parent Document and the content of this document, the JPSS Program Configuration Change Board has the final authority for conflict resolution.

| Doc. No. | Document Title |
|---|---|
| 470-00067 | Joint Polar Satellite System (JPSS) Ground System Requirements Document (GSRD) |
| 470-00067-02 | Joint Polar Satellite System (JPSS) Ground System Requirements Document (GSRD), Volume 2, Science Product Specification |
| 474-00448-01-01 | Joint Polar Satellite System (JPSS) Algorithm Specification Volume I: Software Requirements Specification (SRS) for the Common Algorithms |

## 2.2 Applicable Documents

The following document(s) is (are) the Applicable Document(s) from which this document has been derived. Any modification to an Applicable Document will be reviewed to identify the impact upon this document. In the event of conflict between an Applicable Document and the content of this document, the JPSS Program Configuration Change Board has the final authority for conflict resolution.

| Doc. No. | Document Title |
|---|---|
| D0001-M01-S01-017 | Joint Polar Satellite System (JPSS) VIIRS Snow Cover Algorithm Theoretical Basis Document (ATBD) |
| 474-00448-02-29 | Joint Polar Satellite System (JPSS) Algorithm Specification Volume II: Data Dictionary for the Snow Cover |
| 474-00448-04-29 | Joint Polar Satellite System (JPSS) Algorithm Specification Volume IV: Software Requirements Specification Parameter File (SRSPF) for the Snow Cover |

## 2.3 Information Documents

The following documents are referenced herein and amplify or clarify the information presented in this document. These documents are not binding on the content of this document.

| Doc. No. | Document Title |
|---|---|
| 474-00333 | Joint Polar Satellite System (JPSS) Ground System (GS) Architecture Description Document (ADD) |
| 474-00054 | Joint Polar Satellite System (JPSS) Ground System (GS) Concept of Operations (ConOps) |
| 470-00041 | Joint Polar Satellite System (JPSS) Program Lexicon |

| Doc. No. | Document Title |
|---|---|
| 474-00448-03-29 | Joint Polar Satellite System (JPSS) Algorithm Specification Volume III: Operational Algorithm Description (OAD) for the Snow Cover |
| 429-05-02-42 | Joint Polar Satellite System (JPSS) Mission Data Format Control Book for NPP |
| 472-00251 | Joint Polar Satellite System (JPSS) Mission Data Format Control Book for JPSS-1 |

# 3 Algorithm Requirements

## 3.1 States and Modes

### 3.1.1 Normal Mode Performance

SRS.01.29_87 The Snow Cover Binary Map algorithm shall calculate the snow Binary Map with a 3-sigma mapping uncertainty of 3 km.

*Rationale:* The mapping uncertainty for the product was flowed down from the Level 1 and Level 2 documents.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.29_89 The Snow Cover Binary Map algorithm shall calculate the snow Binary Map with a 90% probability of correct snow/no-snow classification.

*Rationale:* The measurement uncertainty as probability of correct typing was flowed down from the Level 1 and Level 2 documents.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.29_91 The Snow Cover Binary Map algorithm shall calculate the snow Binary Map with an available refresh budget of 90% of the globe every 24 hours, averaged monthly.

*Rationale:* The global coverage through the available refresh constraint was flowed down from the Level 1 and Level 2 documents.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.29_317 The Snow Cover Binary Map algorithm shall calculate the snow Binary Map with a horizontal cell size of 400 m at nadir.

*Rationale:* The horizontal cell size (HCS) was flowed down from the Level 1 and Level 2 documents. The Snow Cover Binary Map product is generated at the HCS of 0.4 km at nadir and .8 km at the edge of scan.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.29_318 The Snow Cover Fraction algorithm shall calculate the snow cover fraction with a horizontal cell size of 800 m at nadir.

*Rationale:* The horizontal cell size (HCS) was flowed down from the Level 1 and Level 2 documents.

The Snow Cover Fraction product is generated at pixel resolution of 0.8 km at nadir and 1.6 km at the edge of scan. The performance of the product is to be met at the same HCS (of 0.8 km at nadir and 1.6 km at edge of scan).

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.29_123 The Snow Cover Fraction algorithm shall calculate the snow fraction with a 3-sigma mapping uncertainty of 3 km.

*Rationale:* The mapping uncertainty for the product was flowed down from the Level 1 and Level 2 documents.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.29_125 The Snow Cover Fraction algorithm shall calculate the snow fraction with a measurement uncertainty of 10% of the FSC area.

*Rationale:* The measurement uncertainty for the snow fraction was flowed down from the Level 1 and Level 2 documents. Snow Fraction uncertainty does not include excluded pixels (e.g. high AOT, large Solar Zenith Angle, and structured scenes, such as forest canopy, mountain peaks, etc.) in its computation.

*Mission Effectivity:* JPSS-1, JPSS-2

SRS.01.29_127 The Snow Cover Fraction algorithm shall calculate the snow fraction with a available refresh budget of 90% of the globe every 24 hours, averaged monthly.

*Rationale:* The global coverage through the available refresh constraint was flowed down from the Level 1 and Level 2 documents.

*Mission Effectivity:* JPSS-1, JPSS-2

### 3.1.2 Graceful Degradation Mode Performance

Not applicable.

## 3.2 Algorithm Functional Requirements

### 3.2.1 Product Production Requirements

Not applicable.

### 3.2.2 Algorithm Science Requirements

SRS.01.29_93 The Snow Cover Binary Map software shall incorporate a computing algorithm provided for the snow cover binary map.

*Rationale:* The EDR software through its computing algorithm must compute the snow cover binary map in accordance with (D0001-M01-S01-017), ATBD for VIIRS Snow Cover.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.29_129 The Snow Cover Fraction software shall incorporate a computing algorithm provided for the snow cover fraction.

*Rationale:* The EDR software through its computing algorithm must compute the snow cover binary map in accordance with (D0001-M01-S01-017), ATBD for VIIRS Snow Cover.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

### 3.2.3 Algorithm Exception Handling

SRS.01.29_95 The Snow Cover Binary Map software shall set <FillField> with <FieldValue> according to <FillCondition> specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <BinaryMap><fill>.

*Rationale:* The EDR software through its computing algorithm must fill the snow cover binary map values based on the established fill conditions to satisfy exclusion and fill conditions.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.29_131 The Snow Cover Fraction software shall set <FillField> with <FieldValue> according to <FillCondition> specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <Fraction><fill>.

*Rationale:* The EDR software through its computing algorithm must fill the snow cover fraction values based on the established fill conditions to satisfy exclusion and fill conditions.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

## 3.3 External Interfaces

### 3.3.1 Inputs

SRS.01.29_122 The Snow Cover Fraction software shall incorporate inputs from the Snow Cover Binary Map.

*Rationale:* The EDR generation software must be able to receive and process the resource interaction items shown in Table 3-1 in order to produce the intended Snow Cover Fraction products.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.29_68 The Snow Cover Binary Map software shall incorporate inputs as specified in Table 3-1.

*Rationale:* The EDR generation software must be able to receive and process the resource interaction items shown in Table 3-1 in order to produce the intended Snow Cover Binary Map products.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.29_432 The Snow Cover software shall ingest tables and coefficients formatted in accordance with Section 7 of the JPSS Algorithm Specification Vol II: Data Dictionary for Snow Cover (474-00448-02-29).

*Rationale:* This defines the formats for Lookup Tables, and Processing Coefficients for input into the algorithm module.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

Table 3-1 and Figure 3-1 are best viewed together since they describe the processes governed by this SRS in different ways. The figure diagrams the data flowing into, out of, and within the code

governed by this SRS. The table lists these same data interactions as well as all downstream dependencies for outputs from this SRS.

Each row in the table describes a single software interaction - data flowing from one software item to another. The data is listed in the first column. The second and third columns include the short name and mnemonic for the data. Blanks indicate there is no mnemonic. The fourth and fifth columns contain the SRS that generates the data product(s) in the first column, and the SRS that receives those products. The final two columns contain the actual function name in Algorithm Development Library (ADL) that produces those products, and the function that inputs those products. The SRS's titled "Ingest MSD" and "Store/Retrieve" are non-existent SRS's functioning as data handling for the IDPS. The software functions "Store Products" and "Retrieve Products" are similar non-existent functions that operate as IDPS data handling.

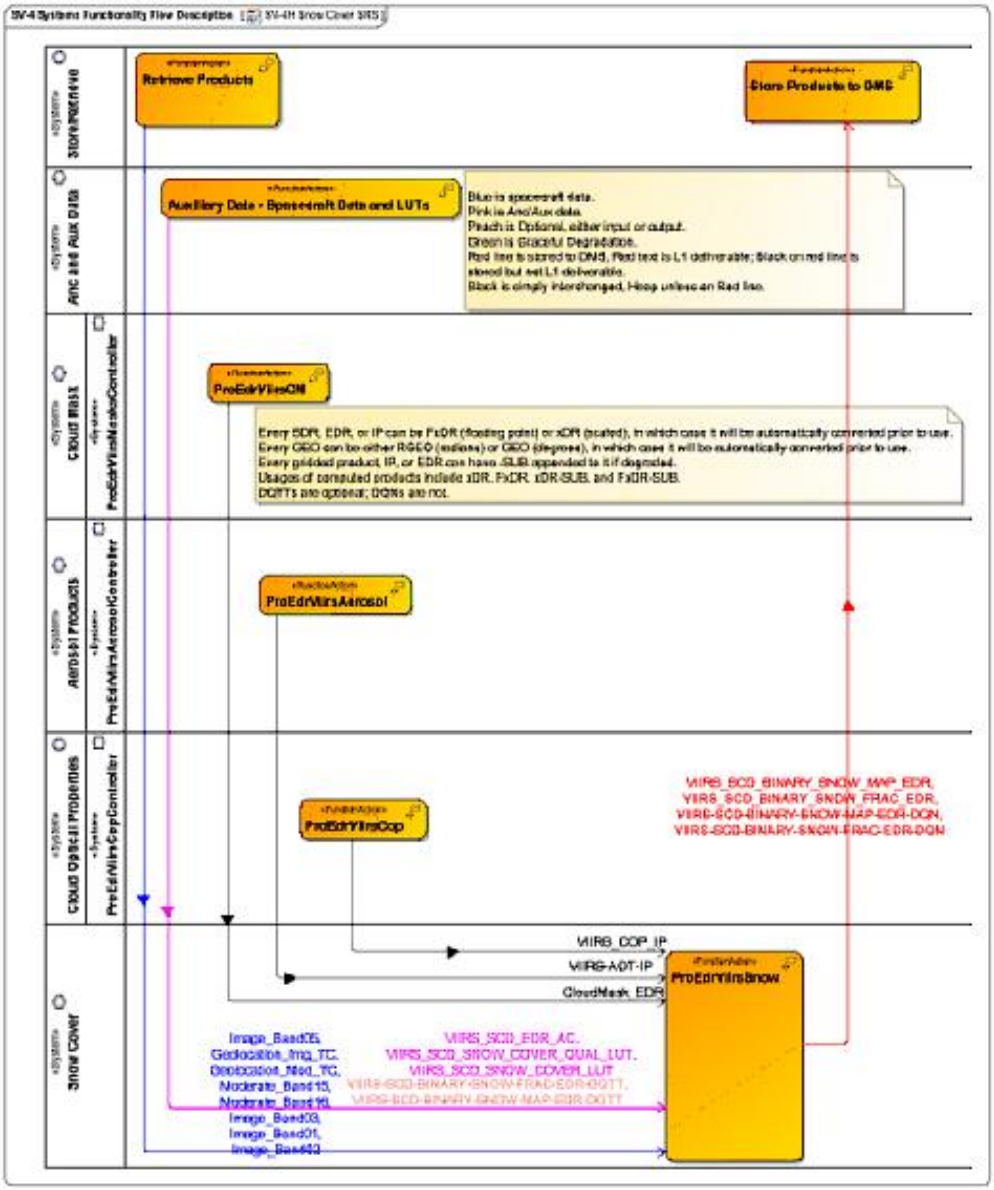


**Figure: 3-1 Snow Cover Data Flows**

**Table: 3-1 Systems Resource Flow Matrix: Snow Cover**

| | Data Product Name | Collection Short Name | Mnemonic | Sending SRS | Receiving SRS | Sending Function | Receiving Function |
|---|---|---|---|---|---|---|---|
| 1 | •Image_Band05<br>•Geolocation_Img_TC<br>•Geolocation_Mod_TC<br>•Moderate_Band15<br>•Moderate_Band16<br>•Image_Band03<br>•Image_Band01<br>•Image_Band02 | •VIIRS-I5-SDR<br>•VIIRS-IMG-RGEO-TC<br>•VIIRS-MOD-RGEO-TC<br>•VIIRS-M15-SDR<br>•VIIRS-M16-SDR<br>•VIIRS-I3-SDR<br>•VIIRS-I1-SDR<br>•VIIRS-I2-SDR | •SDRE-VI05-C0030<br>•None<br>•None<br>•SDRE-VM15-C0030<br>•SDRE-VM16-C0030<br>•SDRE-VI03-C0030<br>•SDRE-VI01-C0030<br>•SDRE-VI02-C0030 | Store/Retrieve (VIIRS SDR) | Snow Cover | Retrieve Products | ProEdrViirsSnow |
| 2 | •VIIRS_SCD_EDR_AC<br>•VIIRS_SCD_SNOW_COVER_QUAL_LUT<br>•VIIRS_SCD_SNOW_COVER_LUT | •VIIRS-SCD-EDR-AC<br>•VIIRS-SCD-SNOW-COVER-QUAL-LUT<br>•VIIRS-SCD-SNOW-COVER-LUT | •DP_NU-LM2020-001<br>•NP_NU-LM0233-072<br>•NP_NU-LM0233-073 | Anc and Aux Data | Snow Cover | Auxiliary Data - Spacecraft Data and LUTs | ProEdrViirsSnow |
| 3 | •VIIRS-SCD-BINARY-SNOW-FRAC-EDR-DQTT<br>•VIIRS-SCD-BINARY-SNOW-MAP-EDR-DQTT | •VIIRS-SCD-BINARY-SNOW-FRAC-EDR-DQTT<br>•VIIRS-SCD-BINARY-SNOW-MAP-EDR-DQTT | •DP_NU-LM2030-000<br>•DP_NU-LM2030-000 | Anc and Aux Data | Snow Cover | Auxiliary Data - Spacecraft Data and LUTs | ProEdrViirsSnow |
| 4 | •VIIRS-AOT-IP | •VIIRS-Aeros-Opt-Thick-IP | •IMPI_VAOT_R0100 | Aerosol Properties | Snow Cover | ProEdrViirsAerosol | ProEdrViirsSnow |
| 5 | •VIIRS_COP_IP | •VIIRS-Cd-Opt-Prop-IP | •IMPI_VCOP_R0100 | Cloud Optical Properties | Snow Cover | ProEdrViirsCop | ProEdrViirsSnow |
| 6 | •CloudMask_EDR | •VIIRS-CM-EDR | •EDRE-CMIP-C0030 | Cloud Mask | Snow Cover | ProEdrViirsCM | ProEdrViirsSnow |
| 7 | •VIIRS_SCD_BINARY_SNOW_FRAC_EDR | •VIIRS-SCD-BINARY-SNOW-FRAC-EDR | •EDRE-SNCD-C1030 | Snow Cover | Surface Albedo | ProEdrViirsSnow | ProEdrViirsLandSurfAlbedo |
| 8 | •VIIRS_SCD_BINARY | •VIIRS-SCD-BINARY- | •EDRE-SNCD- | Snow Cover | Surface Type | ProEdrViirsSno | ProEdrViirsSur |

| | Data Product Name | Collection Short Name | Mnemonic | Sending SRS | Receiving SRS | Sending Function | Receiving Function |
|---|---|---|---|---|---|---|---|
| | _SNOW_FRAC_EDR | SNOW-FRAC-EDR | C1030 | | | w | fType |
| 9 | •VIIRS_SCD_BINARY_SNOW_FRAC_EDR | •VIIRS-SCD-BINARY-SNOW-FRAC-EDR | •EDRE-SNCD-C1030 | Snow Cover | Grid Gran | ProEdrViirsSnow | ProGipCSGranToGridViirsSnowIce |
| 10 | •VIIRS_SCD_BINARY_SNOW_MAP_EDR | •VIIRS-SCD-BINARY-SNOW-MAP-EDR | •EDRE-SNCD-C1035 | Snow Cover | Grid Gran | ProEdrViirsSnow | ProGipViirsGranToGridDSR |
| 11 | •VIIRS_SCD_BINARY_SNOW_MAP_EDR | •VIIRS-SCD-BINARY-SNOW-MAP-EDR | •EDRE-SNCD-C1035 | Snow Cover | Grid Gran | ProEdrViirsSnow | ProGipViirsGranToGridSnowIceCover |
| 12 | •VIIRS_SCD_BINARY_SNOW_MAP_EDR<br>•VIIRS_SCD_BINARY_SNOW_FRAC_EDR<br>•VIIRS-SCD-BINARY-SNOW-MAP-EDR-DQN<br>•VIIRS-SCD-BINARY-SNOW-FRAC-EDR-DQN | •VIIRS-SCD-BINARY-SNOW-MAP-EDR<br>•VIIRS-SCD-BINARY-SNOW-FRAC-EDR<br>•VIIRS-SCD-BINARY-SNOW-MAP-EDR-DQN<br>•VIIRS-SCD-BINARY-SNOW-FRAC-EDR-DQN | •EDRE-SNCD-C1035<br>•EDRE-SNCD-C1030<br>•DP_NU-L00510-000<br>•DP_NU-L00510-000 | Snow Cover | Store/Retrieve | ProEdrViirsSnow | Store Products to DMS |

### 3.3.2 Outputs

SRS.01.29_67 The Snow Cover Binary Map software shall generate the VIIRS Snow Cover Binary Map product in conformance with the XML format file in Attachment A.2 of the JPSS Algorithm Specification, Vol II: Data Dictionary for the Snow Cover (474-00448-02-29).

*Rationale:* The product profile must conform to the XML format file.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.29_121 The Snow Cover Fraction software shall generate the VIIRS Snow Cover Fraction product in conformance with the XML format file in Attachment A.1 of the JPSS Algorithm Specification, Vol II: Data Dictionary for the Snow Cover (474-00448-02-29).

*Rationale:* The product profile must conform to the XML format file.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.29_140 The Snow Cover Fraction EDR software shall use the terrain-corrected geolocation for VIIRS I-band.

*Rationale:* The EDR product must be associated with the terrain-corrected geolocation to meet the geolocation accuracy requirement.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.29_141 The Snow Cover Binary Map EDR software shall use the terrain-corrected geolocation for VIIRS I-band.

*Rationale:* The EDR product must be associated with the terrain-corrected geolocation to meet the geolocation accuracy requirement.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

## 3.4 Science Standards

Not applicable.

## 3.5 Metadata Output

Not applicable.

## 3.6 Quality Flag Content Requirements

SRS.01.29_103 The Snow Cover Binary Map software shall report for each <FlagScope> quality flags using <FlagLogic> as specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <BinaryMap><QF>.

*Rationale:* Quality Flags must be generated based on the established flag conditions, logic, and format.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.29_139 The Snow Cover Fraction software shall report for each <FlagScope> quality flags using <FlagLogic> as specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <Fraction><QF>.

*Rationale:* Quality Flags must be generated based on the established flag conditions, logic, and format.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

## 3.7 Data Quality Notification Requirements

SRS.01.29_94 The Snow Cover Binary Map software shall send data quality notifications to the operator according to logic specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <BinaryMap><Notification>.

*Rationale:* Notifications must be generated and sent based on the established logic and conditions.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.29_130 The Snow Cover Fraction software shall send data quality notifications to the operator according to logic specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <Fraction><Notification>.

*Rationale:* Notifications must be generated and sent based on the established logic and conditions.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

## 3.8 Adaptation

Not applicable.

## 3.9 Provenance Requirements

Not applicable.

## 3.10 Computer Software Requirements

Not applicable.

## 3.11 Software Quality Characteristics

Not applicable.

## 3.12 Design and Implementation Constraints

SRS.01.29_124 The JPSS Common Ground System software shall execute the Snow Cover Fraction algorithm.

*Rationale:* The CGS must incorporate algorithm changes that are supplied by the algorithm vendor.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

SRS.01.29_316 The JPSS Common Ground System software shall execute the Snow Cover Fraction binary map algorithm.

*Rationale:* The CGS must incorporate algorithm changes that are supplied by the algorithm vendor.

*Mission Effectivity:* S-NPP, JPSS-1, JPSS-2

### 3.13 Personnel Related Requirements

Not applicable.

### 3.14 Training Requirements

Not applicable.

### 3.15 Logistics Related requirements

Not applicable.

### 3.16 Other Requirements

Not applicable.

### 3.17 Packaging Requirements

Not applicable.

### 3.18 Precedence and Criticality

Not applicable.

## Appendix A. Requirements Attributes

The Requirements Attributes Table lists each requirement with CM-controlled attributes including requirement type, mission effectivity, requirement allocation(s), block start and end, method(s) for verifying each requirement, etc.

| Req ID | SRS 29 - Snow Cover | Level 3 Type | Product Type | Mission Effectivity | Allocated To | Block Start | Block End | Block 2.0.0 VM | Block 2.1.0 VM | Block 2.2.0 VM |
|---|---|---|---|---|---|---|---|---|---|---|
| SRS.01.29_87 | The Snow Cover Binary Map algorithm shall calculate the snow Binary Map with a 3-sigma mapping uncertainty of 3 km. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | NA |
| SRS.01.29_89 | The Snow Cover Binary Map algorithm shall calculate the snow Binary Map with a 90% probability of correct snow/no-snow classification. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | NA |
| SRS.01.29_91 | The Snow Cover Binary Map algorithm shall calculate the snow Binary Map with an available refresh budget of 90% of the globe every 24 hours, averaged monthly. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | NA |
| SRS.01.29_317 | The Snow Cover Binary Map algorithm shall calculate the snow Binary Map with a horizontal cell size of 400 m at nadir. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | NA |
| SRS.01.29_318 | The Snow Cover Fraction algorithm shall calculate the snow cover fraction with a horizontal cell size of 800 m at nadir. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | NA |
| SRS.01.29_123 | The Snow Cover Fraction algorithm shall calculate the snow fraction with a 3-sigma mapping uncertainty of 3 km. | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | NA |
| SRS.01.29_125 | The Snow Cover Fraction algorithm shall calculate the snow | P | EDR | JPSS-1 JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | NA |

| Req ID | SRS 29 - Snow Cover | Level 3 Type | Product Type | Mission Effectivity | Allocated To | Block Start | Block End | Block 2.0.0 VM | Block 2.1.0 VM | Block 2.2.0 VM |
|---|---|---|---|---|---|---|---|---|---|---|
| | fraction with a measurement uncertainty of 10% of the FSC area. | | | | | | | | | |
| SRS.01.29_127 | The Snow Cover Fraction algorithm shall calculate the snow fraction with a available refresh budget of 90% of the globe every 24 hours, averaged monthly. | P | EDR | JPSS-1<br>JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Test | NA | NA |
| SRS.01.29_93 | The Snow Cover Binary Map software shall incorporate a computing algorithm provided for the snow cover binary map. | Ap | EDR | S-NPP<br>JPSS-1<br>JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_129 | The Snow Cover Fraction software shall incorporate a computing algorithm provided for the snow cover fraction. | Ap | EDR | S-NPP<br>JPSS-1<br>JPSS-2 | algorithm provider | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_95 | The Snow Cover Binary Map software shall set <FillField> with <FieldValue> according to <FillCondition> specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <BinaryMap><fill>. | E | EDR | S-NPP<br>JPSS-1<br>JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_131 | The Snow Cover Fraction software shall set <FillField> with <FieldValue> according to <FillCondition> specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <Fraction><fill>. | E | EDR | S-NPP<br>JPSS-1<br>JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |

| Req ID | SRS 29 - Snow Cover | Level 3 Type | Product Type | Mission Effectivity | Allocated To | Block Start | Block End | Block 2.0.0 VM | Block 2.1.0 VM | Block 2.2.0 VM |
|---|---|---|---|---|---|---|---|---|---|---|
| SRS.01.29_122 | The Snow Cover Fraction software shall incorporate inputs from the Snow Cover Binary Map. | I | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_68 | The Snow Cover Binary Map software shall incorporate inputs as specified in Table 3-1. | I | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_432 | The Snow Cover software shall ingest tables and coefficients formatted in accordance with Section 7 of the JPSS Algorithm Specification Vol II: Data Dictionary for Snow Cover (474-00448-02-29). | Ft | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_67 | The Snow Cover Binary Map software shall generate the VIIRS Snow Cover Binary Map product in conformance with the XML format file in Attachment A.2 of the JPSS Algorithm Specification, Vol II: Data Dictionary for the Snow Cover (474-00448-02-29). | F | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_121 | The Snow Cover Fraction software shall generate the VIIRS Snow Cover Fraction product in conformance with the XML format file in Attachment A.1 of the JPSS Algorithm Specification, Vol II: Data Dictionary for the Snow Cover (474-00448-02-29). | F | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_140 | The Snow Cover Fraction EDR software shall use the terrain-corrected geolocation for VIIRS I- | Fg | GEO | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |

| Req ID | SRS 29 - Snow Cover | Level 3 Type | Product Type | Mission Effectivity | Allocated To | Block Start | Block End | Block 2.0.0 VM | Block 2.1.0 VM | Block 2.2.0 VM |
|---|---|---|---|---|---|---|---|---|---|---|
| | band. | | | | | | | | | |
| SRS.01.29_141 | The Snow Cover Binary Map EDR software shall use the terrain-corrected geolocation for VIIRS I-band. | Fg | GEO | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_103 | The Snow Cover Binary Map software shall report for each <FlagScope> quality flags using <FlagLogic> as specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <BinaryMap><QF>. | Q | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_139 | The Snow Cover Fraction software shall report for each <FlagScope> quality flags using <FlagLogic> as specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <Fraction><QF>. | Q | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_94 | The Snow Cover Binary Map software shall send data quality notifications to the operator according to logic specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <BinaryMap><Notification>. | N | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_130 | The Snow Cover Fraction software shall send data quality notifications to the operator | N | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |

| Req ID | SRS 29 - Snow Cover | Level 3 Type | Product Type | Mission Effectivity | Allocated To | Block Start | Block End | Block 2.0.0 VM | Block 2.1.0 VM | Block 2.2.0 VM |
|---|---|---|---|---|---|---|---|---|---|---|
| | according to logic specified in the JPSS Algorithm Specification, Vol IV: SRSPF for the Snow Cover (474-00448-04-29) <Fraction><Notification>. | | | | | | | | | |
| SRS.01.29_124 | The JPSS Common Ground System software shall execute the Snow Cover Fraction algorithm. | Ai | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |
| SRS.01.29_316 | The JPSS Common Ground System software shall execute the Snow Cover Fraction binary map algorithm. | Ai | EDR | S-NPP JPSS-1 JPSS-2 | CGS | 2.0.0 | 3.0.0 | Inspection | NA | NA |